

## CLAIMS

I claim:

- 1 1. A method for causing hypothermia, said method comprising:  
2 providing a circulating fluid apparatus having a chiller and a flexible catheter, said  
3 catheter having an inner lumen and a hollow flexible heat transfer element  
4 adjacent its distal tip;  
5 inserting said catheter through the vascular system of a patient to place said heat  
6 transfer element in a portion of the vasculature;  
7 supplying chilled fluid to said inner lumen of said catheter;  
8 cooling the interior of said heat transfer element with said chilled fluid;  
9 cooling blood flowing in said portion of the vasculature with said heat transfer  
10 element; and  
11 returning said fluid to said chiller.

1     2.     A method for selective organ hypothermia, said method comprising:  
2     providing a circulating fluid apparatus having a chiller and a flexible coaxial  
3           catheter, said catheter having an insulated inner lumen and a hollow  
4           flexible heat transfer element adjacent its distal tip;  
5     inserting said catheter through the vascular system of a patient to place said heat  
6           transfer element in a feeding artery of a selected organ;  
7     supplying chilled perfluorocarbon fluid to said insulated inner lumen of said  
8           coaxial catheter;  
9     cooling the interior of said heat transfer element with said chilled perfluorocarbon  
10           fluid;  
11     cooling blood flowing in said feeding artery with said heat transfer element, to  
12           enable said cooled blood to flow distally into said selected organ and cool  
13           said organ; and  
14     returning said perfluorocarbon fluid to said chiller.

1     3.     A method for selective organ hypothermia, said method comprising:  
2             providing a coaxial catheter, said catheter having an insulated inner lumen and a  
3                 metallic heat transfer element;  
4             introducing said coaxial catheter into the vascular system of a patient to place said  
5                 metallic heat transfer element in a feeding artery of an organ of the patient;  
6             cooling said metallic heat transfer element by circulating a refrigerant through  
7                 said insulated inner lumen of said coaxial catheter;  
8             cooling blood in said feeding artery by contact with said cooled metallic heat  
9                 transfer element; and  
10            cooling said organ by flow of said cooled blood through said feeding artery.

1 4. A method for selective brain hypothermia, comprising:  
2 providing a flexible coaxial catheter, said flexible catheter having an insulated  
3 inner lumen and a flexible metallic heat transfer element;  
4 introducing said flexible coaxial catheter into the vascular system of a patient to  
5 place said flexible metallic heat transfer element in the carotid artery of the  
6 patient;  
7 cooling said flexible metallic heat transfer element by circulating a refrigerant  
8 through said insulated inner lumen of said flexible coaxial catheter;  
9 cooling blood in said carotid artery by contact with said cooled flexible metallic  
10 heat transfer element; and  
11 cooling the brain of the patient by flow of said cooled blood through said carotid  
12 artery.

1 5. A method for selective hypothermia of the heart of a patient, comprising:  
2 providing a flexible coaxial catheter, said flexible coaxial catheter having an  
3 insulated inner lumen and a flexible metallic heat transfer element;  
4 introducing said flexible coaxial catheter into the vascular system of a patient to  
5 place said flexible metallic heat transfer element in a feeding artery of the  
6 heart of the patient;  
7 cooling said flexible metallic heat transfer element by circulating a refrigerant  
8 through said insulated inner lumen of said flexible coaxial catheter;  
9 cooling blood in said feeding artery by contact with said cooled flexible metallic  
10 heat transfer element; and  
11 cooling the heart of the patient by flow of said cooled blood through said feeding  
12 artery..

- 1 6. An apparatus for selective organ hypothermia, said apparatus comprising:
- 2 a circulating unit adapted for chilling and circulating a fluid;
- 3 a flexible elongated catheter;
- 4 a flexible tubular outer catheter body on said catheter;
- 5 a flexible fluid supply tube within said outer catheter body, a proximal end of a
- 6 central lumen of said fluid supply tube being connected in fluid flow
- 7 communication with an outlet of said circulating unit;
- 8 a fluid return lumen within said outer catheter body, a proximal end of said fluid
- 9 return lumen being connected in fluid flow communication with an inlet
- 10 of said circulating unit; and
- 11 a flexible heat transfer element mounted to a distal end of said outer catheter
- 12 body, said heat transfer element having a partially helical shape to
- 13 increase the surface area available for heat transfer.

1 7. A cooling apparatus, comprising:  
2 a circulating unit adapted for chilling and circulating a fluid;  
3 a flexible elongated catheter;  
4 a flexible tubular outer catheter body on said catheter;  
5 a flexible, insulated, supply tube within said outer catheter body, a proximal end  
6 of a central lumen of said supply tube being connected in fluid flow  
7 communication with an outlet of said circulating unit;  
8 a return lumen within said outer catheter body, said return lumen substantially  
9 surrounding said fluid supply tube, a proximal end of said return lumen  
10 being connected in fluid flow communication with an inlet of said  
11 circulating unit; and  
12 a flexible heat transfer element mounted to a distal end of said outer catheter  
13 body, said heat transfer element having a partially helical shape to increase  
14 the surface area available for heat transfer;  
15 wherein said fluid supply tube comprises a wall having insulating properties to  
16 reduce heat transfer from said return lumen to said central lumen of said  
17 fluid supply tube.

- 1 8. An apparatus for causing hypothermia, said apparatus comprising:  
2 a circulating unit adapted for chilling and circulating a fluid;  
3 a flexible elongated catheter;  
4 a flexible tubular outer catheter body on said catheter;  
5 a flexible fluid supply tube within said outer catheter body, a proximal end of a  
6 central lumen of said fluid supply tube being connected in fluid flow  
7 communication with an outlet of said circulating unit;  
8 a fluid return lumen within said outer catheter body, a proximal end of said fluid  
9 return lumen being connected in fluid flow communication with an inlet  
10 of said circulating unit; and  
11 a flexible heat transfer element mounted to a distal end of said outer catheter  
12 body, said heat transfer element having an at least partially ballooned  
13 shape to increase the surface area available for heat transfer.



- 1 9. An apparatus for causing hypothermia, said apparatus comprising:  
2 a circulating unit adapted for chilling and circulating a fluid;  
3 a flexible elongated catheter;  
4 a flexible tubular outer catheter body on said catheter;  
5 a flexible fluid supply tube within said outer catheter body, a proximal end of a  
6 central lumen of said fluid supply tube being connected in fluid flow  
7 communication with an outlet of said circulating unit;  
8 a fluid return lumen within said outer catheter body, a proximal end of said fluid  
9 return lumen being connected in fluid flow communication with an inlet  
10 of said circulating unit; and  
11 a flexible heat transfer element mounted to a distal end of said outer catheter  
12 body, said heat transfer element having an at least partially oval shape to  
13 increase the surface area available for heat transfer.